

3M™ Diamond Grade™ DG<sup>3</sup> Reflective Sheeting



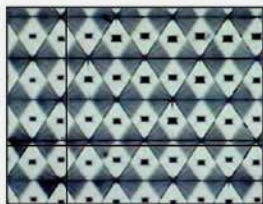
Brighter Signs  
Safer Roads

**3M**

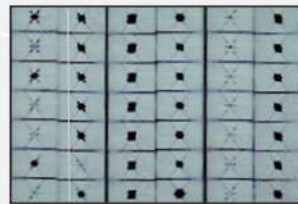
# Trusted Innovation

## To Protect Your Population

According to the Federal Highway Administration (FHWA), the rate of traffic fatalities is three times higher at night than during the day.<sup>1</sup> One of the most important contributing factors is that nighttime drivers often lack the visual cues they receive during daylight. Optimal performance 3M™ Diamond Grade™ DG<sup>3</sup> Reflective Sheeting helps nighttime drivers get the critical visual information they need for a safer drive.



In the physics of prismatic retroreflectivity, three carefully angled surfaces reflect light back to its source. Truncated cube corners return only a portion of that light.



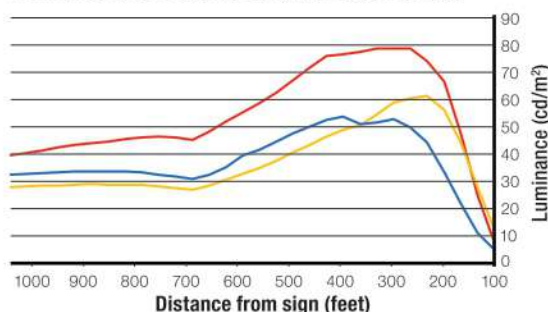
3M™ Diamond Grade™ DG<sup>3</sup> Reflective Sheeting provides full-cube microprisms that are nearly 100% efficient, resulting in sheeting that returns 58% of available light—double the efficiency of truncated cube corners.

The visibility difference comes from 3M's "full-cube" microprisms that are nearly 100 percent efficient, retroreflecting almost all the light that strikes them. When this technology is incorporated into Diamond Grade DG<sup>3</sup> reflective sheeting, it greatly increases the brightness of road signs, returning several times more light than glass beads and nearly twice as much light as truncated cube corner optics. 3M's full-cube construction also accommodates the wide range of observation angles from different size vehicles and entrance angles. Even signs in the most disadvantaged locations perform better with Diamond Grade DG<sup>3</sup> sheeting.

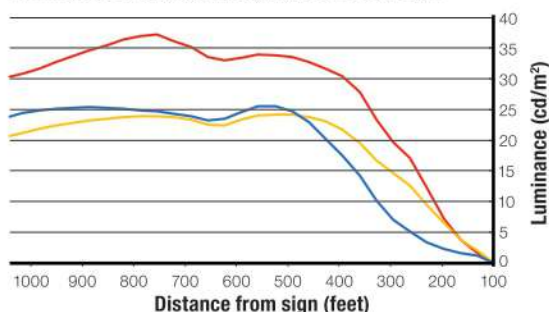
### Sign Luminance Comparisons

Luminance curves show how perceived sign brightness changes as a driver approaches a sign.

Luminance for a Passenger Car; Right Shoulder Sign



Luminance for a Large Truck; Right Shoulder Sign



Key:

- 3M's ASTM Type XI
- 3M's ASTM Type IX
- 3M's ASTM Type IV

# Brighter Signs Mean Safer Roads

How important are brighter signs? A study from the University of Iowa found a direct relationship between a sign's brightness and a driver's ability to see the sign and its message. Study participants were able to read and understand brighter signs substantially faster.<sup>2</sup> This study suggests that brighter signs require less eyes-off-the-road time, leaving drivers more focused on the task of driving—an especially important advantage when driving at night.

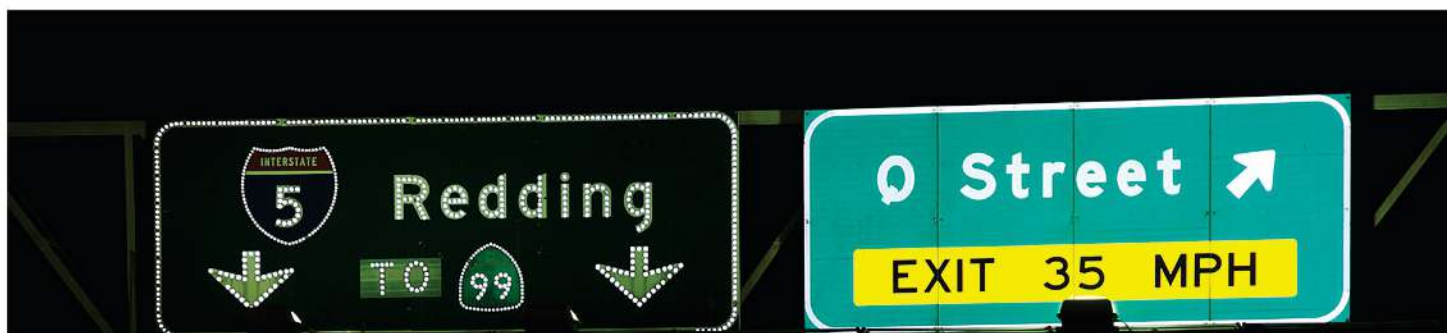
Diamond Grade DG<sup>3</sup> sheeting offers industry-leading retroreflectivity and boasts outstanding conspicuity and legibility thanks to its highly efficient retroreflective optics. It helps improve safety by providing higher luminance values than other sheeting at the distance most critical to drivers—500 feet (150 meters) and closer.

In studies, reflective sheeting like DG<sup>3</sup> reduced crashes 25–48 percent at a better than 10:1 cost-benefit ratio.<sup>3</sup> At twice the brightness of lower grade sheeting, Diamond Grade DG<sup>3</sup> is ideal for all kinds of roadway signage.

Signs that seem similar during the day may perform quite differently at night.



Most signs are readable during the day.



Less efficient sheeting with glass bead reflectors

DG<sup>3</sup> Reflective Sheeting

At night, the difference is clearly visible.



# The Performance You Need To Serve All Drivers

In recent years, critical factors converged to make low-grade road signs less visible and less effective.

- The population of older drivers is growing rapidly.
- More vehicles are utilizing VOA, low cut-off headlights.
- The amount of large vehicle traffic is increasing.

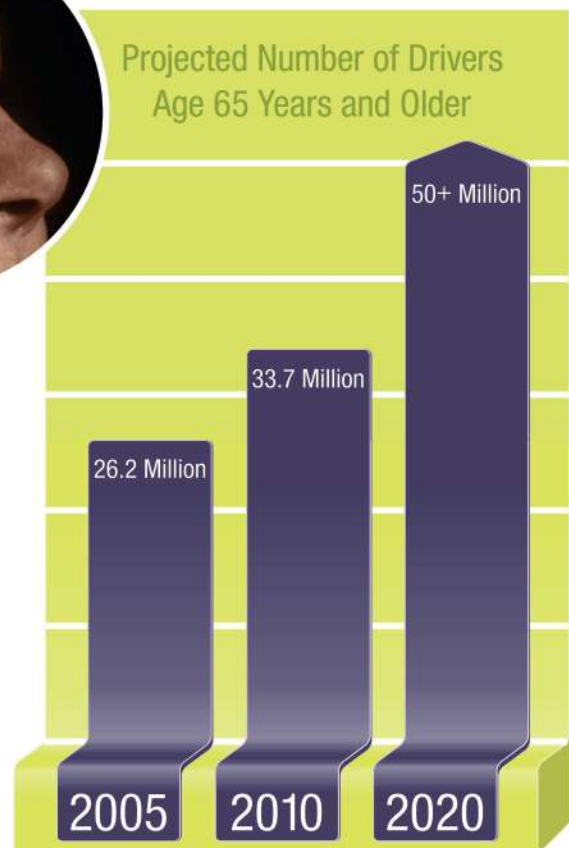
3M™ Diamond Grade™ DG<sup>3</sup> Reflective Sheeting is not only one of the most efficient sheetings in the field under typical conditions, but it also utilizes unique technology to optimize performance in a changing driving environment. Count on innovative Diamond Grade DG<sup>3</sup> to improve traffic sign visibility for all drivers and create a more positive driving experience through safe, efficient travel.

## Accommodating Older Drivers

By 2020, more than 50 million people 65 years of age and older will be driving—about one in every five drivers. Vision, which provides 85 percent of the information necessary to drive, deteriorates with age, so an aging driving population creates the need for more visible road signs. Older drivers:

- need more light—a 60-year-old needs three times more light than a 20-year-old;
- need more contrast—a 60-year-old needs twice the contrast of a 20-year-old;
- have disproportionately more accidents, driving violations and fatalities per mile driven;<sup>4</sup>
- need more time to concentrate and react.

Choose Diamond Grade DG<sup>3</sup> to accommodate the visual needs of older drivers and improve traffic safety with brighter and larger roadway signage.

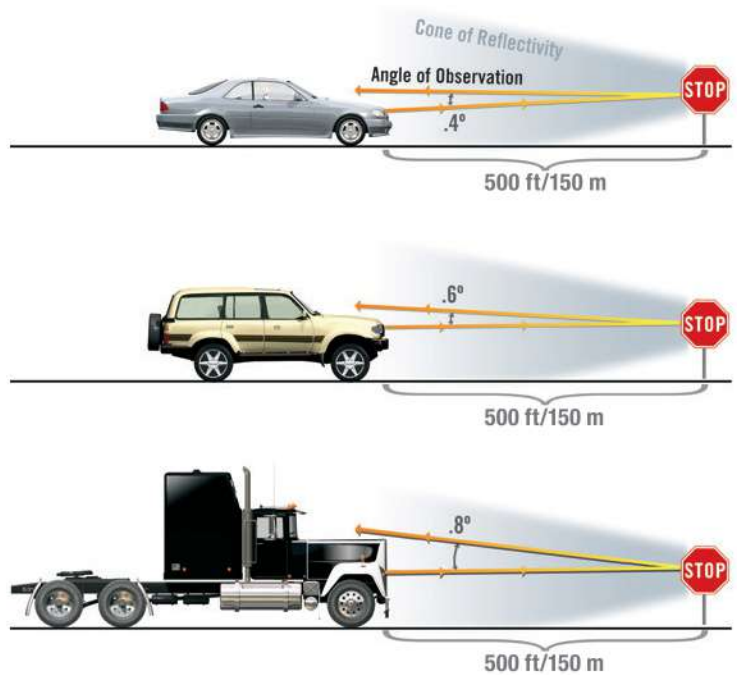




## Optimized Performance From Many Angles

Diamond Grade DG<sup>3</sup> sheeting offers optimized retroreflective performance to make signs more visible for every driver. Vehicle size affects observation angle and reflective sign performance because different sized vehicles create different observation angles between the headlights and the driver's eye level.

Truck traffic has increased 60 percent in the last ten years, and drivers of trucks are especially affected by reflective sign performance, since the angle between the driver's eyes and the headlights is significantly greater. Diamond Grade DG<sup>3</sup>'s unique construction returns more light in a larger cone of reflectivity, making signs appear brighter for these drivers and helping make the roads safer for everyone.



## Retroreflective Efficiency For Low Cut-off Headlights

Visually/optically aimable (VOA) headlights reduce glare for oncoming drivers, but also dramatically reduce reflective sign visibility at night compared to conventional headlights. These headlights reduce the illumination of signs by as much as 48 percent in common sign configurations.<sup>6</sup>

As more cars come equipped with VOA headlights, count on Diamond Grade DG<sup>3</sup> for the performance drivers need to compensate for decreasing amounts of light directed at signs.



Headlight Illumination of Traffic Signs at 500 ft (150 m):  
1997/Conventional Headlights vs. 2011/Low Cut-off Headlights<sup>5,6</sup>

**In 1997**

Left Shoulder	Overhead	Right Shoulder
24%	16%	100% (Benchmark)

**In 2011**

Left Shoulder	Overhead	Right Shoulder
30%	22%	52%

In tandem, these factors lead to decreased sign effectiveness, resulting in less luminance from traffic signs and compromised traffic safety. Trust the ultimate performance of signs made with DG<sup>3</sup>'s full-cube technology to better serve the needs of the changing roadway environment and help save lives.



# Do More With Less

Departments of transportation across the United States are looking for ways to improve traffic sign visibility and save taxpayer dollars. Many are finding one solution that helps achieve both goals—upgrading to traffic signs made with high performance, full-cube reflective sheeting from 3M.

3M™ Diamond Grade™ DG<sup>3</sup> Reflective Sheeting has the demonstrated performance on which agencies can rely. With the best retroreflectivity in the industry, DG<sup>3</sup> can help decrease crashes and related costs, such as medical and insurance expenses, increased taxes and emergency response costs.



3M helps traffic engineers achieve safety and efficiency goals by offering an excellent life cycle value so agencies can do more with less. DG<sup>3</sup> is one of the most sustainable and efficient reflective sheetings on the market, with an industry-leading expected life of 12 years. It also can help traffic agencies reduce maintenance and energy expenses by eliminating guide sign lighting where advantageous.

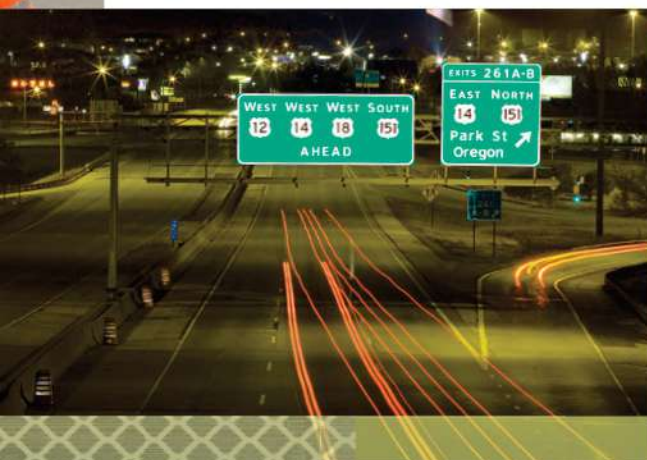
Compared to other engineering improvements, the cost of upgrading to DG<sup>3</sup> is relatively small, and the safety benefits are clear—improved visibility and fewer crashes. DG<sup>3</sup> is better, safer and lasts longer than other retroreflective sheeting, leading to lower costs and maintenance over time.



# Driver Safety

## Is Top Priority

Your top priority is safer roads for all drivers. With the highest luminance values at the distance that matters most, Diamond Grade DG<sup>3</sup> sheeting helps to reduce crashes and fatalities. The driving environment is changing, making sign visibility more critical than ever. Trust 3M to deliver cost-effective, high performance sheeting that your drivers can depend on.



Learn more by visiting

[3M.com/roadwaysafety](https://www.3m.com/roadwaysafety)

For assistance with sign upgrades,  
contact your 3M representative.

## REFERENCES

1. [http://safety.fhwa.dot.gov/roadway\\_dept/retro/gen/back\\_needs.htm](http://safety.fhwa.dot.gov/roadway_dept/retro/gen/back_needs.htm)
2. Schell, T., Yekhshatyan, L., Daiker, R., Konz, J., Effect of Luminance on Information Acquisition Time and Accuracy from Traffic Signs. Paper accepted for presentation and publication, Transportation Research Record, Journal of the Transportation Research Board, 2008. Full report available at <http://ccad.uiwoa.ded/opl/projects/luminance>
3. Ripley, 2004 ITE Annual Meeting Proceedings
4. Leonard Evans, TRB submission, 1991
5. Slivak, M. University of Michigan Transportation Research Institute, 2000-2001
6. Schoettie, B., Flannagan M., An Analysis of Low-Beam and High-Beam Headlighting Performance in the U.S.: 1997–2011. University of Michigan Transportation Research Institute, 1997–2011

**3M** representative



Jugoslovenska 2, 11250 Beograd  
Tel: +381 11 6581274, 6581275  
[www.sitotehnika.net](http://www.sitotehnika.net)  
[office@sitotehnika.net](mailto:office@sitotehnika.net)



Aerodromska 17, 71000 Sarajevo, tel: +387 33 719095, 66 002600, e-mail: [sasastgraf@gmail.com](mailto:sasastgraf@gmail.com)  
Pilanska bb, 78000 Banja Luka, tel: +387 51 305280, 66 002400, e-mail: [stgrafbl@gmail.com](mailto:stgrafbl@gmail.com)  
Lagja Kalabria pn, 10000 Priština, tel: +383 38 602080, 45 600641, e-mail: [info@stgraf-ks.com](mailto:info@stgraf-ks.com)  
Bulevar Boris Trajkovski 112, 1000 Skoplje, tel: +389 78 290996, e-mail: [ace@sitotehnika.net](mailto:ace@sitotehnika.net)

Pratite nas:

